

Environmental Protection Agency

§ 91.320

Example calibration points (percent)	Acceptable for calibration?
10, 25, 40, 55, 70, 85	Yes.
10, 30, 50, 70, 90	No, though equally spaced and entire range covered, a minimum of six points is needed.

(4) Additional calibration points may be generated. For each range calibrated, if the deviation from a least-squares best-fit straight line is two percent or less of the value at each data point, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds two percent at any point, use the best-fit non-linear equation which represents the data to within two percent of each test point to determine concentration.

(d) The initial and periodic interference, system check, and calibration test procedures specified in 40 CFR part 1065, subparts C and D, may be used in lieu of the procedures specified in this section.

[61 FR 52102, Oct. 4, 1996, as amended at 70 FR 40451, July 13, 2005]

§ 91.319 NO_x converter check.

(a) The efficiency of the converter used for the conversion of NO₂ to NO is tested as given in paragraphs (a)(1) through (a)(8) of this section (see Figure 2 in appendix B to this subpart).

(1) Using the test setup as shown in Figure 2 in appendix B to this subpart (see also § 91.318 of this chapter) and the procedures described in paragraphs (a)(2) through (a)(8) of this section, test the efficiency of converters by means of an ozonator.

(2) Calibrate the HCLD in the most common operating range following the manufacturer's specifications using zero and span gas (the NO content of which must amount to about 80 percent of the operating range and the NO₂ concentration of the gas mixture less than 5 percent of the NO concentration). The NO_x analyzer must be in the NO mode so that the span gas does not pass through the converter. Record the indicated concentration.

(3) Calculate the efficiency of the NO_x converter as described in § 91.318(b).

(4) Via a T-fitting, add oxygen continuously to the gas flow until the con-

centration indicated is about 20 percent less than the indicated calibration concentration given in paragraph (a)(2) of this section. Record the indicated concentration as "c". The ozonator is kept deactivated throughout the process.

(5) Activate the ozonator to generate enough ozone to bring the NO concentration down to about 20 percent (minimum 10 percent) of the calibration concentration given in paragraph (a)(2) of this section. Record the indicated concentration as "d".

NOTE: If, with the analyzer in the most common range the NO_x converter cannot give a reduction from 80 percent to 20 percent, then use the highest range which will give the reduction.

(6) Switch the NO analyzer to the NO_x mode, which means that the gas mixture (consisting of NO, NO₂, O₂ and N₂) now passes through the converter. Record the indicated concentration as "a".

(7) Deactivate the ozonator. The mixture of gases described in paragraph (a)(6) of this section passes through the converter into the detector. Record the indicated concentration as "b".

(8) Switched to NO mode with the ozonator deactivated, the flow of oxygen or synthetic air is also shut off. The NO_x reading of the analyzer may not deviate by more than ±5 percent of the theoretical value of the figure given in paragraph (a)(2) of this section.

(b) The efficiency of the converter must be tested prior to each calibration of the NO_x analyzer.

(c) The efficiency of the converter may not be less than 90 percent.

§ 91.320 Carbon dioxide analyzer calibration.

(a) Prior to its introduction into service, and monthly thereafter, or within one month prior to the certification test, calibrate the NDIR carbon dioxide analyzer as follows:

(1) Follow good engineering practices for instrument start-up and operation. Adjust the analyzer to optimize performance.

(2) Zero the carbon dioxide analyzer with either purified synthetic air or zero-grade nitrogen.

(3) Calibrate on each normally used operating range with carbon dioxide-

§91.321

in-N₂ calibration or span gases having nominal concentrations between 10 and 90 percent of that range. A minimum of six evenly spaced points covering at least 80 percent of the 10 to 90 percent range (64 percent) is required (see following table).

Example calibration points (percent)	Acceptable for calibration?
20, 30, 40, 50, 60, 70	No, range covered is 50 percent, not 64 percent.
20, 30, 40, 50, 60, 70, 80, 90 ..	Yes.
10, 25, 40, 55, 70, 85	Yes.
10, 30, 50, 70, 90	No, though equally spaced and entire range covered, a minimum of six points is needed.

(4) Additional calibration points may be generated. For each range calibrated, if the deviation from a least-squares best-fit straight line is 2 percent or less of the value at each data point, concentration values may be calculated by use of a single calibration factor for that range. If the deviation exceeds 2 percent at any point, use the best-fit non-linear equation which represents the data to within 2 percent of each test point to determine concentration.

(b) The initial and periodic interference, system check, and calibration test procedures specified in 40 CFR part 1065, subparts C and D, may be used in lieu of the procedures in this section.

[61 FR 52102, Oct. 4, 1996, as amended at 70 FR 40451, July 13, 2005]

§91.321 NDIR analyzer calibration.

(a) *Detector optimization.* If necessary, follow the manufacturer's instructions for initial start-up and basic operating adjustments.

(b) *Calibration curve.* Develop a calibration curve for each range used as follows:

- (1) Zero the analyzer.
- (2) Span the analyzer to give a response of approximately 90 percent of full-scale chart deflection.
- (3) Recheck the zero response. If it has changed more than 0.5 percent of full scale, repeat the steps given in paragraphs (b)(1) and (b)(2) of this section.
- (4) Record the response of calibration gases having nominal concentrations between 10 and 90 percent of full-scale concentration. A minimum of six evenly

40 CFR Ch. I (7–1–07 Edition)

ly spaced points covering at least 80 percent of the 10 to 90 percent range (64 percent) is required (see following table).

Example calibration points (percent)	Acceptable for calibration?
20, 30, 40, 50, 60, 70	No, range covered is 50 percent, not 64 percent.
20, 30, 40, 50, 60, 70, 80, 90 ..	Yes.
10, 25, 40, 55, 70, 85	Yes.
10, 30, 50, 70, 90	No, though equally spaced and entire range covered, a minimum of six points is needed.

(5) Generate a calibration curve. The calibration curve must be of fourth order or less, have five or fewer coefficients, and be of the form of equation (1) or (2). Include zero as a data point. Compensation for known impurities in the zero gas can be made to the zero-data point. The calibration curve must fit the data points within 2 percent of point or one percent of full scale, whichever is less.

$$y = Ax^4 + Bx^3 + Cx^2 + Dx + E \quad (1)$$

$$y = \frac{x}{Ax^4 + Bx^3 + Cx^2 + Dx + E} \quad (2)$$

y=concentration
x=chart deflection

(6) Option. A new calibration curve need not be generated if:

(i) A calibration curve conforming to paragraph (b)(5) of this section exists;

(ii) The responses generated in paragraph (b)(4) of this section are within one percent of full scale or two percent of point, whichever is less, of the responses predicted by the calibration curve for the gases used in paragraph (b)(4) of this section.

(7) If multiple range analyzers are used, the lowest range used must meet the curve fit requirements below 15 percent of full scale.

(c) *Linear calibration criteria.* If any range is within 2 percent of being linear, a linear calibration may be used. To determine if this criterion is met:

(1) Perform a linear least-square regression on the data generated. Use an equation of the form $y=mx$, where x is the actual chart deflection and y is the concentration.

(2) Use the equation $z=y/m$ to find the linear chart deflection (designated as z)